

2) The numerical ratings for each of the four factors were summed for each of the dominant soil series and/or phase found in the mapping unit and multiplied by the percentage of the entire mapping unit that each soil series and/or phase occupies. These values were then summed over all soils in the map unit. This is illustrated in the table below.

<u>SOIL SERIES</u>	<u>%</u>	<u>PERM.</u>	<u>DEPBDRK</u>	<u>DEPWATR</u>	<u>FLDFREQ</u>	<u>RATING</u>
Newdale	24 *	(2 +	1 +	8 +	4) =	360
Wheelerville	15 *	(20 +	8 +	0 +	0) =	420
Rexburg	57 *	(8 +	1 +	0 +	0) =	513
<hr/>						
TOTAL	96%					1293
	pts					

3) The summed value (1293) was then normalized for the percentage of soils in the map unit used in the calculation (96%). In this case, 1293 would be divided by 96 to come up with a weighted soils susceptibility rating of 13 points for that STATSGO soils unit.

The weighted score for each STATSGO mapping unit was then multiplied by three to determine the final soils susceptibility rating. This gives a maximum possible rating of 120 points (although scores did not exceed 100 points), giving the soils layer a maximum relative importance of 2.4 times over the other two layers. The soils layer received a greater weighting because the soils layer incorporates more than one criteria which determine susceptibility assessment (permeability, depth to bedrock, depth to water-table, and flooding frequency), whereas the depth-to-water and recharge layers only rate one criteria (Mike Ciscell, former Remote Sensing Analyst, IDWR, personal communication, January, 1991).

#### VULNERABILITY MAP

##### 1) Development of the Vulnerability Map








The Ground Water Vulnerability map (Figure 6) was generated by merging the three maps (depth-to-water, recharge, and soils) into one map using GIS techniques. The point ratings from each map were added together to create a final map with additive vulnerability point scores.

The vulnerability map was then broken into low, moderate, high, and very high vulnerability categories. The division points for these categories were derived by graphing the relationship of total acres versus total vulnerability score (Figure 7). The top ten percent with the highest



# Relative Groundwater Vulnerability : Idaho Snake River Plain

## Vulnerability Ratings

-  Low vulnerability
-  Moderate vulnerability
-  High vulnerability
-  Very high vulnerability
-  Urban areas
-  Water
-  Not in study area

A cooperative project between:

- Idaho Dept. of Health & Welfare
- Idaho Dept. of Water Resources
- USDA Soil Conservation Service
- United States Geological Survey



Map Location



Edition  
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vulnerability ratings were placed into the very high vulnerability class to reduce the skewness of the distribution. The remaining distribution was then divided equally into thirds, with a final breakdown of 30% = low, 30% = moderate, 30% = high, and 10% = very high (Figure 8). This is a first approximation at splitting out the categories which will be refined in the near future after comparison of the vulnerability maps to ground water monitoring data.

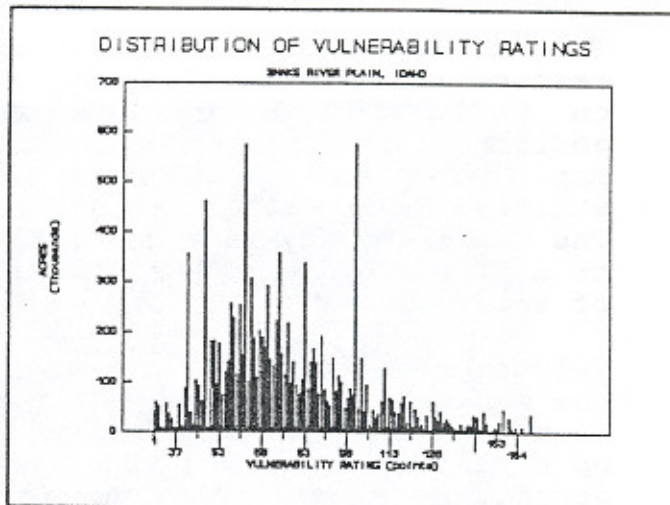


Figure 7: Graph showing the distribution of relative vulnerability ratings versus total acres within the Snake River Plain.

## 2) Uses of Vulnerability Maps.

The vulnerability maps are designed to serve as a tool for prioritization of ground water management activities. Areas of higher vulnerability can be given priority for prudent ground water protection measures in order to assure that limited resources are effectively used in areas of greatest concern. Programs

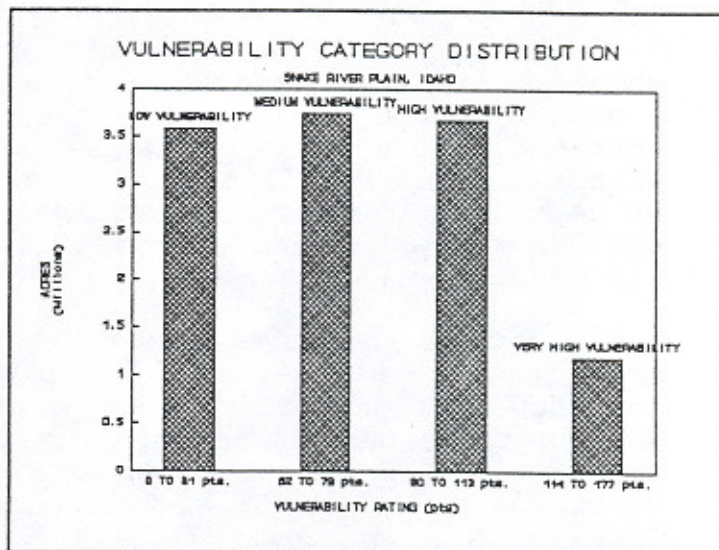


Figure 8: Graph showing the distribution of vulnerability categories within the Snake River Plain.

which can utilize vulnerability maps include underground storage tanks, wellhead protection, ground water monitoring, public water supplies, agricultural chemicals, waste water management, best management practice (BMP) implementation and development, hazardous waste management, state and federal superfund programs, land use planning, State underground tank insurance agencies, and public information.



The vulnerability maps also provide a valuable data base resource for future studies. Since the maps were developed on a GIS, all information can be readily accessed, and additional information can be added to them. The individual map layers on soils, depth-to-water, or recharge can be utilized by any other project requiring similar information. The vulnerability maps can also be merged with, compared to, or utilized by any other GIS data layer to perform a variety of analyses.

Vulnerability maps provide a very cost effective approach to the management of ground water quality activities. The cost of producing these maps are a fraction of the cost to clean up contaminated ground water resources. Their benefits for ground water quality protection far outweigh their initial cost of production.

### 3) Limitations of Vulnerability Maps

The vulnerability maps described in this document highlight areas sensitive to ground water contamination in a generalized way. Because of the scale of mapping (1:250,000 for soils and depth-to-water layers, 1:100,000 for the recharge layer) that was incorporated in the development of these maps, they should be used for regional program planning purposes only, and should not be used for making site specific decisions such as whether to site a landfill in a particular location. For instance, there could be smaller areas of high vulnerability within low vulnerability areas and vice versa. The maps can be used as a first-cut approximation of the vulnerability of certain areas, but more in-depth studies must be performed for site-specific applications.

These maps do not show areas that will be contaminated, or areas that cannot be contaminated. Likewise, these maps do not show if a particular area has already been contaminated. Whether the area will have ground water contamination depends upon the likelihood of contaminant release, the type of contaminants released, and the frequency of that release. These maps only consider the ability of water to move from the land surface to the water table and do not consider the individual characteristics of specific contaminants.

Users of these maps should keep in mind that a low vulnerability rating is not an invitation for uncontrolled land-use practices. A low vulnerability rating merely suggests that there is a lower chance of ground water contamination than in areas of higher vulnerability. Just about any ground water resource can be contaminated if it is subjected to improper land use practices. The use of substances such as a restricted-use pesticide in a low



vulnerability area should only be done under the oversight of an effective ground water monitoring program to assure that the substance is not adversely affecting ground water resources.

## **FUTURE GOALS**

### **1) Statewide Mapping**

A primary goal of the Idaho Ground Water Vulnerability Project is to develop a statewide map. Accordingly, mapping of the existing layers will be expanded on a statewide basis as much as funding levels and data availability allow. In this way, the affected programs can be addressed on a statewide basis as soon as possible.

### **2) Pilot Projects**

Additional layers incorporating data not previously evaluated will be mapped by the Idaho Ground Water Vulnerability Project on a pilot project scale in the near future. This will help determine whether additional data layers can be developed on a cost-effective basis to further refine the vulnerability maps. Possible projects include an updated land-use layer, a vadose-zone layer, an updated recharge layer based on consumptive use, or other DRASTIC data layers that have not been developed yet.

### **3) Field Verification**

Field verification is an important aspect to developing ground water vulnerability maps. Field verification is performed by overlaying known ground water quality data on the vulnerability maps and observing whether there is a correlation. After taking local ground water flow directions into account, the majority of contamination problems should be located in areas marked as high or very high vulnerability. Figure 9 shows an initial comparison of the vulnerability map for the Snake River Plain to ground water monitoring data collected by Idaho's Statewide Ground Water Monitoring Project during the summer of 1990. In this study, 52 wells were sampled in the Snake River Plain, and out of those wells 13 had anomalous detections of triazine herbicides, VOCs, and nitrates. All wells that had anomalous levels of contaminants were located in high or very high vulnerability categories, or in urban areas which were not rated by this study. Although this is not a statistically-valid comparison, it certainly lends credibility to the vulnerability maps.

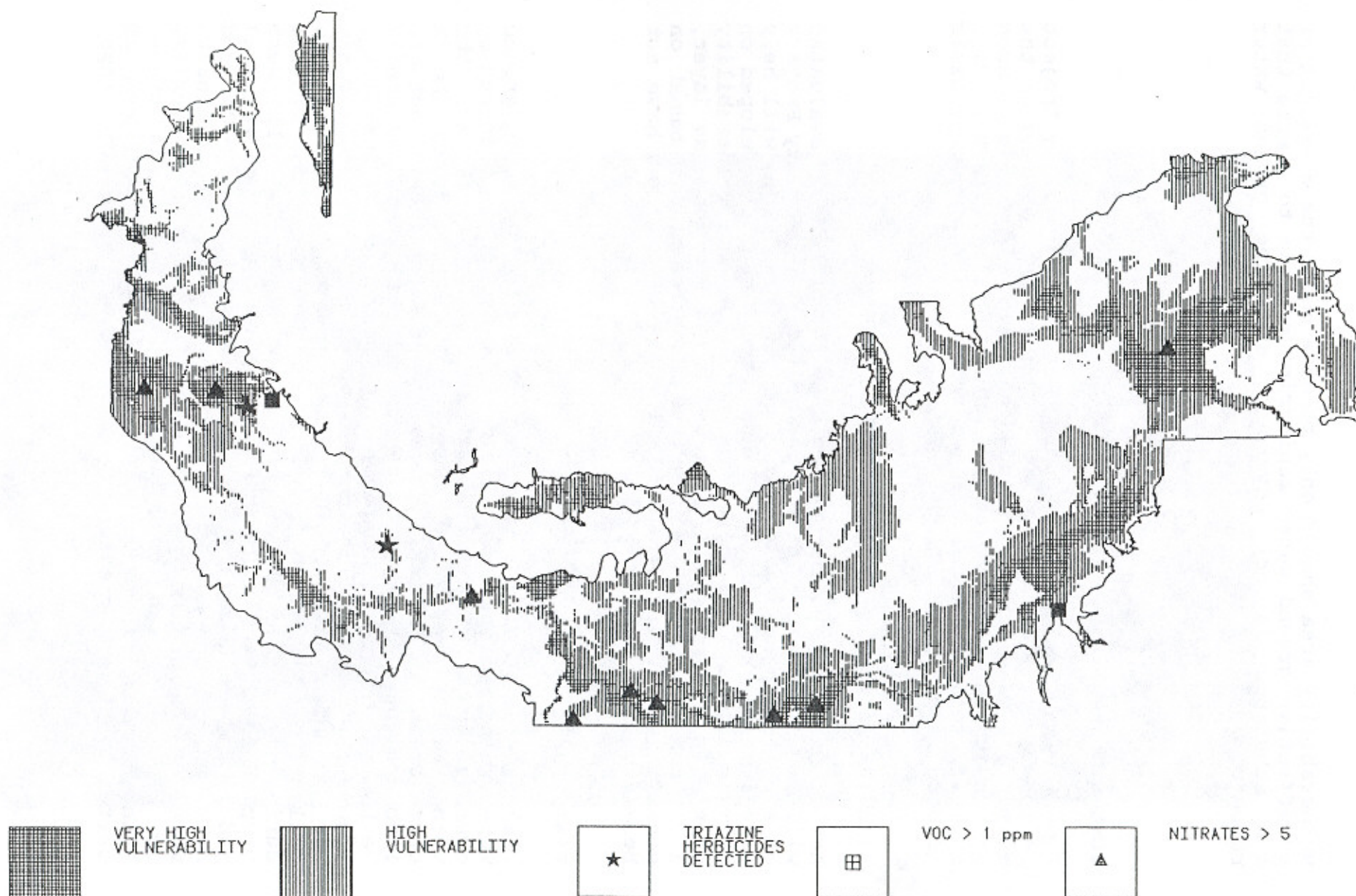


Figure 9: Comparison of data from the 1990 Statewide Monitoring Project to High and Very High Vulnerability Categories. Low and Medium Vulnerability Categories not shown.



Initial comparisons with other monitoring data also show good correlations. Additional comparisons will be made in the near future to form statistically-valid interpretations of the effectiveness of the maps. Comparison studies with monitoring data will be an ongoing element in refinement of the vulnerability maps. The point rating schemes may be adjusted in the future in response to this comparison with ground water monitoring data after the results from the statistically-valid studies.

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